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Medus operandi of Mercury
Cristie

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Penn^a -

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James Smith
June 2

admitted March 22, 1850

A Dissertation
on the
Modus Operandi
Of
Mercury.)

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A
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No originality in an essay on any branch of medical science, cannot be expected from one, who has devoted but three or four years in acquiring a knowledge of its various branches. A science which presents so wide and diversified a field for inquiry and research, as would occupy the most diligent student, many years, to examine attentively, the various theories, that have at different times prevailed.

The subject of this essay, is one, on which I cannot hope for originality; and the difficulties of which are so well expressed, by Dr. John Warren of Massachusetts, that I shall take the liberty of quoting

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his own words; "Sensible of the extreme difficulty of establishing any rational theory on the modus operandi of mercury, I offer these suggestions with great diffidence, far from being ambitious of originality, on one hand, and very little studious, on the other, of conforming them to any system whatever.

When a man of such extensive experience, acknowledges the difficulties attendant on the establishing of a rational theory, any thing from me beyond a compilation cannot be expected.

The examination of some of the preparations of the medicine, will be necessary, to explain their effects on the body, and the different degrees of activity which they possess.

Mercury has been very aptly denominated the samson of the collateria Medica. It is the dictate of prudence to be assured, before we admit it into the strong holds of the system, whether it will act the part of a friend, in defending it against the disease that assails it; or, whether it may

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not be likely to pull down the pillars of the human constitutions.

That such suspicions have existed, and do still exist, a history of this practice sufficiently evinces, and which are further corroborated, by the assertion of one of the most respectable practitioners of this city; who states that he has to regret the average loss of one patient a year, and yet he cannot reproach himself with an improper use of the remedy.

In investigating the effects of this medicine upon the human body, the subject naturally divides itself into the following heads.

- 1st The nature of the medicine, and of its preparations;
- 2^d Its general operation upon the living body.

Under the first of these heads, it would be proper to examine such preparations of mercury as are in common use.

Under the second the manner of their operation upon the human constitution.

Mercury is a metal of a silver-white colour;

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and fluid at the usual temperature of the atmosphere. Its specific gravity, at 47° above 0 of Fahrenheit, being 13.545. It is found imbedded in the earth in many parts of the world, sometimes perfectly pure, when it is called virgin mercury, but most commonly it is found combined with some extraneous bodies from which it is separated by chemical processes.

It is now universally admitted, that mercury in its metallic state possesses no medicinal powers independent of its ponderosity, and hence it is no longer employed. To fit it for our purposes, it is variously modified by chemical and pharmaceutical treatment. The process by which these conversions are accomplished, may perhaps be reduced to oxidation in different degrees, and a union with acids, forming the mercurial salts.

By long continued trituration with saccharine, oily, or mucilaginous substances, the particles of mercury are minutely divided and slightly oxidated by having their surfaces repeatedly exposed to the atmosphere.

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efficacious. They are numerous, but as they all agree in the leading and material properties, I shall confine myself to such only as are in use at the present time.

Ustula Hydrargyri

The blue pill is made by triturating, two parts of purified quicksilver with three parts of the conserve of roses, and then adding one part of powdered liquorice root.

This is one of the best preparations of mercury, being not at all disposed to purge. There is indeed no indication which can be fulfilled by mercury, the purgative effect excepted, to which this preparation is not adapted. Emet. It is particularly useful where salivation is demanded, being as effectual as calomel and infinitely less harsh in its operation.

Unguentum Hydrargyri Fortius

Take of purified mercury, by weight two pounds, prepared lard, twenty three ounces; prepared suet, an ounce.

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and a little of the lard, then add the rest of the lard, and form it into an ointment. (Cosa suspensory)

Unguentum Hydrargyri Mitius

This is made by adding two parts of hogs lard, to one part of the strong ointment.

By uniting the mercury with unctuous matter, it exists partly in a state of minute mechanical division and partly in the state of an oxide. By many the oxidation of the metal was denied; but it is now ascertained that this process does take place and it seems highly probable that the efficacy of the ointment is principally owing to this circumstance. For the test of the perfect preparation of mercurial ointment is the total disappearance of the particles of the metal on the ointment being rubbed on paper, or on its being melted. Moreover this extension of the globules as it has been technically denominated is much facilitated by such processes as contribute to the oxidation of the metal.

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The ointment is generally applied by friction on the inside of the thighs and legs, in the track of the absorbents; yet it is sometimes used as an enema in cases of emergency, one or two drachms of of the strong ointment is to be intimately blended with a small quantity of mucilage.

Sulphuretum Hydrargyri Rubrum

Is made by adding forty ounces of purified mercury to eight ounces of sublimed sulphur in a state of fusion, the mass is afterwards to be reduced to a powder and sublimed.

This preparation of mercury is used principally as an escharotic; it is however frequently employed in the form of fumigations. For this purpose half a drachm is to be taken and thrown on burning coals, the fumes being inhaled with the breath are said to produce a violent salivation. X

Hydrargyri Muriciatus Corrosivus

Take of purified quicksilver, two pounds; Sulphuric acid, two pounds and a half; dried muriate of

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soda, four pounds. Boil the quicksilver, with the sulphuric acid in a glass vessel placed in a sand bath, until the mass be dried. Mix the mass when cold with the muriate of soda, then sublime in a glass cucurbit, with a heat gradually increased. Lastly separate the sublimed matter from the scoria (Dox's Dispensatory)

This is the most powerful of all the mercurial preparations. The dose cannot safely exceed one fourth of a grain, the usual dose to commence with is from one eighth to one sixth of a grain, either in form of a pill or solution in water or acrid spirit.

Hydroargyri Muriatis Mitis

The last of the preparations of mercury of which I shall speak is calomel. It differs chemically from the corrosive muriate of mercury, merely containing less oxygen, and a smaller quantity of muriatic acid. It is therefore a submuriate of mercury, and is so denominated in the Edinburgh Pharmacopoea.

Calomel is considered as the most valuable

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of all the mercurial preparations, and admits
of the widest application in the practice of our
professions.

*The General operation of Mercurials
on the body.*

There appear to have been various theories on the
modus operandi of mercury. Some have supposed,
that the specific gravity of the particles of mercury
might give it more than usual force in dividing
the coherent portions of our fluids; diminishing
the consistence of the blood; and very much in-
creasing its fluidity; but if it be attended to that
as the particles of all bodies, by being divided,
have their surfaces so much enlarged, in proportion
to their quantity of matter, that the resistance to
their passage through fluids is so much increased,
that the heaviest of all bodies, gold, can be so
divided as to be suspended in water; and though
we cannot precisely determine how much the
particles of mercury may be divided in its

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different preparations, yet it may be confidently presumed, that in all of them they are so much divided as to take off entirely the effect of their gravity. I saw a case in the almshouse this summer of a woman who had taken but three grains of mercury, and yet she was affected with a profuse salivation. In this instance the ptyalism could not have been induced by the specific gravity of the mercury. I have also seen several instances of salivation brought on by a common cathartic of Calomel and Jalap; such facts I think render this doctrine utterly untenable; for though it may be difficult to detect their chemical properties, yet, if they acted upon mechanical principals, they might be undoubtedly discovered by their weight, whereas no such ponderous particles have been discovered in the blood.

It has been maintained by some writers that mercury exerts a specific gravity action on the noxious matters themselves in the animal body.

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separate from the diseased actions in the body. If mercury acted on the noxious matter only, it might be supposed to be in two ways, either by destroying its qualities by decomposing it, or by attracting it and carrying it out of the constitution. If the first were the action of mercury, then we might reasonably suppose that quantity alone was to be depended upon, if the second, that the quantity of the evacuation would be the principal circumstance.

But physicians of the present day, recognise no specific medicines; and are willing to keep open the door of investigation on such subjects as are unexplained, by acknowledging their want of information, & exciting an inquiry into the more abstruse and unexplained regions of medical science.

The opinion, that mercurial medicines produce their effects on the body by acting as stimulants, is probably the most prevalent and the best supported of any yet advanced.

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The property of irritability in the animal body is the basis on which this theory is founded.

Stimulants may be defined to be such powers as are capable of increasing the action of parts. This they do by acting on the irritable fibre, even when separated from the brain, and by producing sensation under other circumstances. The most obvious effects of mercurials on the body are such as correspond with the phenomena of excitement, or the action of a stimulant on the irritability.

That mercury, in a combined state, is a stimulant, is evident from the following considerations.

The preparations of mercury increase the action of the stomach and intestines. The peristaltic motion of these organs is by most of the preparations of this mineral, sensibly, and by some of them powerfully, excited; and the emetic and cathartic effects are among their most active properties.

They act very powerfully on the glandular organs by increasing their secretions, and promoting

discharges from ^{the} excretories of the skin, salivary glands, and other emunctories, almost without exception, throughout the body.

They increase the action of the heart and arteries, quickening the pulse in some instances, and in others rendering it stronger and fuller; consequently increasing the momentum of the circulating blood, and in this way rousing the whole system into action; and it is this action which constitutes the febris mercurialis of salivated patients.

Operation of Mercurials as Stimulants

Whether mercurial preparations produce their effects by acting upon the surfaces to which they are applied, and so affecting the other parts of the system by sympathy, or whether they are absorbed into the vessels, and hence extend their stimulant powers over the body, are questions which have not been resolved.

That the emetic and cathartic operation of these medicines depends on their action as compound

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bodies on the stomach and intestines, I should suppose would hardly be denied, when it is considered, that no known powers exist in these organs, capable of deoxygenating mercury, according to the common rules which govern that function, a longer space of time, it should seem, would be required for the purpose. It is known that no degree of heat exists in the stomach sufficient to reduce these oxides; we may, therefore, venture to conclude, that their evicuant effects depend upon their compound action on the surfaces to which they are applied.

It may be next enquired, whether these medicines are absorbed into the blood vessels, being taken up by the absorbents of those surfaces, and carried into the common mass of the blood, thus pervading the ultimate ramifications of that system even to the secretory organs and exhalents of the body; or whether they act upon the glands and other remote parts from sympathy alone.

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whole effect upon the first passages and the absorbent surfaces in general, there would be no reason to suppose the necessity of any absorption into the system.

The phenomena of salivation might then be solved on the principle of sympathy; and both the metal and the oxygen be considered as essentials.

On the supposition that the very extensive effects of those medicines upon the constitution are not to be accounted for on this hypothesis, search has been made for them in the blood and other fluids.

If no deoxygenation could have taken place, previous to absorption, (admitting absorption to have taken place) the mercury must have existed, at some period, within the system in its compound state.

There have been a number of experiments made for the purpose of detecting any mercury that might have been absorbed into the mass of the fluids; upon persons under the full influence of a mercurial course. They have furnished no evidence that either the blood or saliva becomes impregnated with the metallic substance. ✓

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The doctrine, that mercurial medicines act in consequence of their oxygen alone originated with Dr Beddoes and Girtanner; and Dr Alton declares that he has prepared an oxygenated ointment, which was far superior to the blue ointment, and which produced the same effects.

It may be true that oxygen is an essential constituent of most salivating medicines, and yet, that the activity of the mercurial preparations may not depend on this alone. Opium and seneka, it has been known, will salivate also; but no oxygen is furnished by these articles.

That the general stimulant power of oxygen, is strengthened and extended, by its union with the quicksilver, appears probable; and several considerations favour the conclusion, that it is absorbed into the blood vessels, besides the fact that no separation of the two constituents is evinced by deoxygenation in the stomach.

Mercury is found to produce no sensible effect on the salivary glands, even in the highest doses, in less than twelve hours; but if it operated in this way,

sympathetically, or as a stimulant, merely by first acting upon the surfaces of the *primæ viæ*, or of the skin it might be expected to act sooner. This seems to support the opinion of absorption.

According to Dr. Christolm, oxygenous gas, obtained from mercurial oxides, almost always hold a quantity of mercury in solution; and Cheptal saw two instances of speedy salivation, where it had been used for diseases of the lungs; a strong instance of the facility with which this form of administration may be used. From breathing pure oxygen alone we do not learn that salivation has ensued.

Oxygen obtained from the oxygenated muriate of potash will not salivate.

That which is furnished by nitrous acid will ~~an-~~
formly salivate in hot climates. +

The use of the metallic part of the preparations of mercury, may be to convey the combined oxygen to all parts of the system, there to suffer a gradual evolution of this part of the compound, in an equal

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and uniform manner, and communicate it to every part of the body; thus acting as a powerful stimulant upon the bloodvessels, particularly pervading the glands, exerting an increased action in their secretory and excretory ducts; for the purpose of effecting which, the nature of the oxide, and the universality of its distribution, are so admirably adapted.

There are several ways in which these medicines are employed, with a view of introducing them into the system; but all of them are by the skin, the organs of respiration, and the alimentary canal. By the latter comprehending the stomach, the large intestines, (when by enema) and the inside of the mouth, the introduction of the medicine is, in general, easily effected; but by the former, it is sometimes found to be not readily accomplished.

The absorbents of the skin have been thought free to imbibe such articles, especially in a fluid form, as are presented to them, unless their peculiar qualities prevent their admission. Modern discoveries, however,

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have rendered it doubtful whether such powers exist in the degree, which has been generally believed; and have proved, that without mechanical means (force, friction) it is difficult to introduce medicines in this way.

The orifices of the absorbents are so seated under the cuticle, that it is sometimes, almost impossible to make mercurial unguents enter them without removing that covering.

There have been a number of experiments performed by Dr. Rousseau of this City, which go to prove that there are but very few substances taken up by the cutaneous absorbents; he exposed the whole surface of his body to the fumes of mercury, and yet avoided a salivation by breathing through a pipe which led out of the room into the common atmosphere.

In whichever way, whether by the skin or through the medium of respiration, mercury is received into the system, the preparation probably undergoes a gradual decomposition, by a sort of digestive action of

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the vessels, the metal giving a kind of fixation to the oxygen, by which it is conveyed and applied to the extremities of the secreting and exhalant vessels.

That it actually pervades the system, and passes through the cutaneous vessels to the surface of the body, is evinced by its there producing the proper mercurial influence upon such other metallic substances as are exposed to it, for instance the watch, or finger-rings of the salivated subject.

Admitting that the medicine is thus actually absorbed, it is true, on the supposition that the oxygen is partly expended upon the blood vessels or solids of the body, it would be reasonable to expect, that the metallic part of the medicine should somewhere appear in its ^{elementary} proper form.

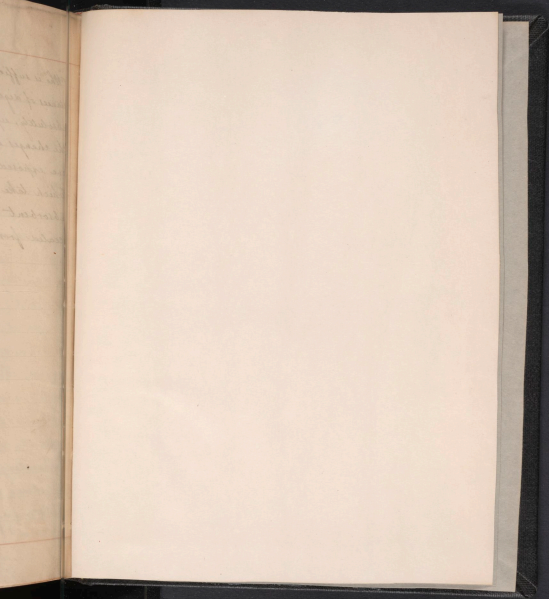
But is there any thing unphilosophical in conjecturing, that this deoxygenating process, the vessels not only separating the oxygen from the metal, for certain purposes, in the mass of the fluids but also expelling the latter from the surface, in such a manner as not generally to admit of detection?

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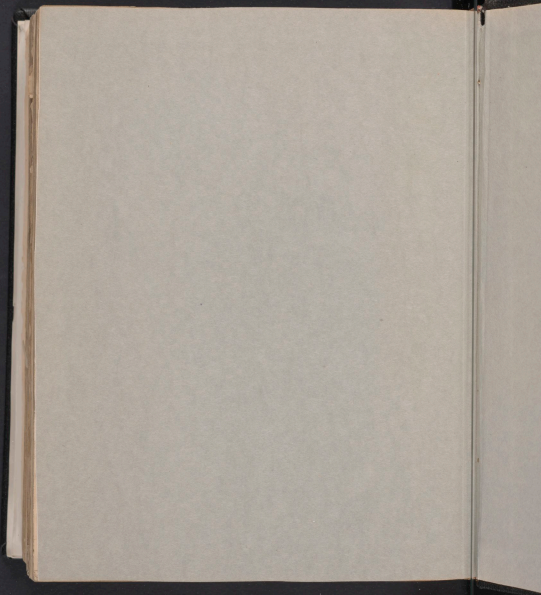
Who is sufficiently acquainted with all the circumstances of digestion in the stomach, to pronounce, absolutely, upon the nature of that function, or upon the changes which the variety of substances which are exposed to its action undergo? The processes which take place in the blood vessels and the absorbent and exhalant system, are equally concealed from our researches.

This is sufficiently significant with all the circum-
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